

## CLAIMS

What is claimed is:

1. A hard disk drive, comprising:
  - an enclosure;
  - a disk mounted to the enclosure and rotatable relative to the enclosure;
  - an actuator mounted to the enclosure and movable relative to the enclosure, the actuator having a read/write head for reading data from and writing data to the disk; and
  - a limit stop mounted to the enclosure for limiting movement of the actuator relative to the disk; the limit stop further comprising:
    - a core mounted to the enclosure;
    - a collar mounted to the core and having an exterior that is external relative to the core, and the exterior being formed from a damping material;
    - an impact member mounted to the core and having an outer portion that covers at least a portion of the exterior of the collar, such that the outer portion forms an initial point of contact for the actuator, and the outer portion being formed from a material that is essentially linear in elastic behavior; and
    - the collar provides damping for the actuator after the actuator initially impacts the impact member.
2. The hard disk drive of claim 1, wherein the impact member is a cylindrical spring.
3. The hard disk drive of claim 1, wherein the core is a rigid pin, the collar is formed from a molded polymer, and the impact member is a cylindrical spring.
4. The hard disk drive of claim 1, wherein the outer portion of the impact member is spaced apart from and free of contact with the collar.

5. The hard disk drive of claim 1, wherein the impact member is a flat spring formed in a cylindrical shape and cantilevered relative to the core.
6. The hard disk drive of claim 1, wherein the impact member is plastic spring comprising a crown that is mounted to a distal end of the core.
7. The hard disk drive of claim 1, wherein the impact member is a coiled spring that surrounds the collar and is secured to the core with a cap.
8. The hard disk drive of claim 7, wherein the core comprises a base with a pin protruding therefrom, the collar is mounted to the pin and is positioned on the base, the cap is mounted to the pin and is positioned on the collar, the coiled spring covers at least portions of both the collar and the cap, and the base, the pin, the collar, the cap, and the coiled spring are all coaxial relative to each other.
9. The hard disk drive of claim 1, wherein the limit stop is used only during a self servo write process and is movable relative to the enclosure, such that the limit stop is not used during normal operations of the hard disk drive, and further comprising an auxiliary limit stop that is used to limit motion of the actuator during normal operations of the hard disk drive.

10. A hard disk drive, comprising:

an enclosure;

a disk mounted to the enclosure and rotatable relative to the enclosure;

an actuator mounted to the enclosure and pivotable relative to the enclosure, the actuator having a read/write head for reading data from and writing data to the disk during a self servo write process;

an inner limit stop mounted to the enclosure for limiting pivotal movement of the actuator toward the disk; and

an outer limit stop mounted to the enclosure for limiting pivotal movement of the actuator away from the disk; each of the inner and outer limit stops further comprising:

a core mounted to the enclosure and having a central axis, a base, a pin extending from the base, and a slot formed in the pin;

a collar mounted to the pin of the core and having an exterior that is radially external relative to the pin, and the exterior being formed from an elastic damping material;

a spring having a flexible outer portion with a generally cylindrical shape, and a mounting portion connected to the flexible outer portion, the mounting portion being secured in the slot of the pin of the core, the outer portion surrounding at least a portion of the exterior of the collar, such that the outer portion forms an initial point of contact for the actuator during the self servo write process, and the outer portion being formed from a material that is essentially linear in elastic behavior; and

the collar provides damping for the actuator after the actuator initially impacts the spring.

11. The hard disk drive of claim 10, wherein the collar is formed from a molded polymer, and the spring is cantilevered to the core.

12. The hard disk drive of claim 10, wherein the outer portion of the spring is radially spaced apart from and free of contact with the collar.

13. The hard disk drive of claim 10, wherein the spring is a stainless steel flat spring formed in a cylindrical shape and cantilevered to the core, and the mounting portion extends from one end of the outer portion such that the spring has a split ring configuration.

14. The hard disk drive of claim 10, wherein the spring is formed from plastic, the mounting portion and the outer portion extend from a crown, and the crown is mounted to a distal end of the pin of the core.

15. The hard disk drive of claim 10, wherein the inner and outer limit stops are used only during the self servo write process and is movable relative to the enclosure, such that the inner and outer limit stops are not used during normal operations of the hard disk drive, and further comprising auxiliary limit stops that are used to limit motion of the actuator during normal operations of the hard disk drive.

16. A hard disk drive, comprising:  
an enclosure having a locating pin;  
a disk mounted to the enclosure and rotatable relative to the enclosure;  
an actuator mounted to the enclosure and movable relative to the enclosure, the actuator having a read/write head for reading data from and writing data to the disk; and  
a limit stop mounted to the enclosure for limiting movement of the actuator relative to the disk; the limit stop further comprising:  
a nonlinear element mounted to enclosure via the locating pin;  
a linear element mounted to the enclosure located adjacent to the nonlinear element, the linear element being an initial point of contact for the actuator.
17. The hard disk drive of claim 16, wherein the linear element is spaced apart from the nonlinear element by a clearance.
18. The hard disk drive of claim 16, wherein the linear element is supported one end by the locating pin.
19. The hard disk drive of claim 16, wherein the linear element is supported on two ends by the locating pin.
20. The hard disk drive of claim 16, wherein the linear element is mounted directly to the enclosure and is spaced apart from the locating pin.
21. The hard disk drive of claim 16, wherein the linear element is movable relative to the nonlinear element.
22. The hard disk drive of claim 21, wherein the linear element is accessible from an exterior of the enclosure.